The Need to Repeat Lumbar Puncture

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SUMMARY

Four patients with bacterial meningitis are reported. On initial examination 1 patient had a slightly abnormal cerebrospinal fluid (CSF), and in the other 3 patients the CSF was completely normal. An obviously purulent CSF was obtained when lumbar puncture was repeated 14 - 48 hours later. All 4 patients presented initially with pyrexia, and either neck stiffness or convulsions. In 3 of the 4 patients a cause for pyrexia was found on initial examination but lumbar punctures were done for neck stiffness or convulsions to exclude meningitis. The problems and the need to repeat a lumbar puncture, as well as the importance of blood cultures in a patient with suspected meningitis, are discussed. The fact that a normal specimen of CSF does not exclude meningitis is stressed.

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Pyrexia with neck stiffness, or convulsions, or both signs, are common presenting signs of meningitis in small children, the diagnosis being confirmed by examination of the cerebrospinal fluid (CSF). Cases of meningitis have been recorded, however, when the initial CSF was entirely normal, but when the diagnosis was made after a second specimen had been examined. The following case histories confirm this possibility.

CASE REPORTS

Case 1

A Coloured boy, aged 14 months, presented with a 1-day history of pyrexia and a subsequent generalized convulsion. There was no history of convulsions or trauma. On examination the temperature was 38,5°C and, apart from an erythematous throat and a congested nose, the physical examination was normal. Lumbar puncture produced a CSF which showed 13 lymphocytes, 1 polymorphonuclear leucocyte, total protein 26 mg/100 ml, no globulin, and glucose 89 mg/100 ml. No organisms were seen on Gram staining and none was grown on culture of the CSF. No specific treatment was given but the child was observed overnight. The following morning he was apyrexial and clinically well, but in the light of the slightly elevated lymphocyte count, it was decided to repeat the lumbar puncture. This was done 14 hours after the first lumbar puncture. The fluid showed innumerable white cells, mainly polymorphs, total protein 150 mg/100 ml, globulin +++ and glucose 47 mg/100 ml. The Gram stain revealed Gram-negative diplococci, morphologically indistinguishable from *Neisseria meningitidis*. Culture yielded a growth of the organism.

Case 2

A 6-month-old Coloured boy presented with a 3-day history of pyrexia and coughing. His temperature was 37,8°C, his throat was erythematous and his drumheads were markedly inflamed. There was some terminal neck stiffness but no Kernig's or Brudzinski's sign. In view of the neck stiffness associated with pyrexia, a lumbar puncture was done. The CSF was clear and contained no cells. The total protein was 30 mg/100 ml, globulin was absent and the glucose content was 52 mg/100 ml. Treatment with ampicillin orally for the otitis media was begun and the patient was observed overnight. The following morning he was apyrexial and clinically well; he was discharged.

He returned approximately 36 hours after the lumbar puncture, having had a generalized convulsion. At this stage his temperature was 38°C, he was very irritable and had marked neck stiffness and Kernig's and Brudzinski's signs were elicited. Lumbar puncture was repeated. The fluid was cloudy and contained innumerable polymorphs. The total protein was 450 mg/100 ml, with globulin ++. The glucose content was less than 10 mg/100 ml. Gram staining revealed Gram-negative intracellular diplococci morphologically indistinguishable from *Neisseria meningitidis*.

Case 3

A 19-month-old Coloured boy presented with a 1-day history of pyrexia, irritability and a subsequent generalized convulsion. The mother was a known epileptic. On examination, his temperature was 38°C; he was very irritable and had moderate neck stiffness, but no localizing neurological signs were elicited. He was slightly tachypnoeic, and scattered rhonchi were heard over the lung fields with a few crepitations in the right mid-zone. X-ray examination of the chest revealed patchy bronchopneumonic changes involving the right upper and middle lobes. In view of the neck stiffness a lumbar puncture was done. The CSF contained no cells, the total protein was 26 mg/100 ml, globulin was absent and the glucose was 68 mg/100 ml. Treatment with penicillin was begun for the bronchopneumonia, and in view of the history of convulsions and a family history of epilepsy, he was also given phenobarbitone orally and was observed overnight.

The following morning he was noted to be apyrexial and clinically well, with no neck stiffness. However, because of our experience with patients 1 and 2, but for no other good clinical or scientific reason, it was decided to repeat the lumbar puncture before discharging the patient. This

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was done 19 hours after the first lumbar puncture, and the CSF revealed innumerable white cells, mainly polymorphs. The total protein was 850 mg/100 ml, with globulin ++++ and a glucose of 5 mg/100 ml. Culture yielded a growth of *Neisseria meningitidis.*

Case 4

A 4-year-old Coloured boy presented with a 1-day history of pyrexia, vomiting and, later, a generalized convulsion. His temperature was 37,4°C. He had no neck stiffness and no localizing neurological signs. A pleural rub was heard on the right side of the chest but there were no other extraneous sounds. X-ray examination of the chest revealed no pulmonary pathology and a tentative diagnosis of pleurisy was made. A lumbar puncture was done routinely after a convulsion. The CSF was clear and contained cells. The total protein was 20 mg/100 ml, globulin was absent and the glucose was 82 mg/100 ml. The patient was given no specific treatment and was observed overnight.

The following day he was well clinically. He was given paracetamol for the pyrexia and was discharged. He returned the next morning, however, still pyrexial, and having had a generalized convulsion. He now had marked neck stiffness and Kernig's and Brudzinski's signs were elicited. The CSF obtained by lumbar puncture was cloudy and contained numerous polymorphs and several lymphocytes. Culture yielded growth of *Neisseria meningitidis.*

DISCUSSION

The diagnosis of meningitis after lumbar puncture has revealed a normal CSF has been well documented.[1-3]

This poses a definite problem regarding the need to repeat lumbar puncture after obtaining a normal CSF in order not to miss the diagnosis of bacterial meningitis. The problem is made worse by the fact that clinical examination may reveal a cause for pyrexia.

It is possible that lumbar puncture in the presence of a bacteraemia or septicaemia could be responsible for the subsequent development of meningitis, the damaged meninges becoming a nidus for circulating organisms.[1-3] Fisher *et al.*[3] have suggested that the production of a defect in the meninges could allow a leak of blood into the CSF, thus seeding the CSF. Petersdorf *et al.*[4] have shown experimentally that they could produce meningitis in dogs by performing cisternal puncture within 2 minutes of giving a dose of 10^9 pathogenic organisms intravenously. They also noted that it required at least 10^3 organisms per ml of blood at the time of cisternal puncture to produce meningitis.

Until recently it was believed doubtful whether bacteraemic or even septicaemic patients could achieve a blood bacterial concentration nearly as high as that required by Petersdorf *et al.*[4] to produce meningitis in dogs. Dietzman *et al.*[5] have, however, shown that in septicaemic neonates 30% had a bacteria count $>10^3$/ml of blood and that 60% of these had meningitis, whereas when bacterial counts were less than 10^3/ml of blood, only 1 in 20 developed meningitis. Pray,[6] on the other hand, showed that the incidence of meningitis in children who had a lumbar puncture during the course of a pneumococcal bacteraemia was no greater than in bacteraemic patients who did not undergo the procedure.

In view of the very high morbidity and mortality associated with meningitis, and the simplicity of the technique of lumbar puncture, particularly in paediatric practice, it is widely accepted that lumbar puncture should be done when there is any suspicion at all of meningitis. This should include any very ill child with a pyrexia of uncertain origin. The assurance that meningitis has been excluded by a normal CSF is particularly hazardous. 'The importance of recognizing that a single lumbar puncture does not rule out meningitis cannot be overemphasized.'[3]

Deterioration in the clinical condition of a patient for whom the suspicion of meningitis was initially sufficient to warrant a lumbar puncture, justifies a repetition of the lumbar puncture, possibly even before blood culture results are available. In addition, patients who have an obvious cause for pyrexia, and have had a lumbar puncture for mild neck stiffness, or convulsion, or undue irritability, but who fail to respond to treatment for the apparent cause of the pyrexia, should also have the lumbar puncture repeated.

Ideally, blood cultures should be done at the time of a lumbar puncture, but this may not always be practicable. Because several patients who had bacteraemia at the time of an initially normal CSF and who subsequently developed meningitis have been described,[2,3,7] a positive blood culture 'mandates a repeat lumbar puncture',[3] particularly in small infants in whom the incidence of meningitis in the face of septicaemia is very high. In our patients continuing pyrexia, slight neck stiffness, convulsions, and deterioration in the clinical condition despite treatment for the apparent cause of the pyrexia, warranted repetition of the lumbar puncture — with positive results. In 3 of the 4 patients there were definite indications for repeating the lumbar punctures. In patient 3 lumbar puncture was repeated because of our experience with the other 3 patients, and we have been impressed by the need to repeat lumbar puncture in any patient whose clinical course is not entirely satisfactory, or who does not respond well to treatment of the apparent cause of the pyrexia.

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